Unit 2: Part B (Chapter 6)

6.1 Slope of a Line

LESSON FOCUS Determine the slope of a line segment and a line.

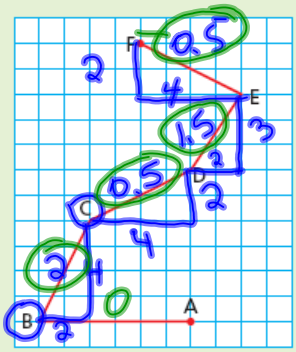
Make Connections

The town of Falher in Alberta is known as *la capitale du miel du Canada*, the Honey Capital of Canada. It has the 3-story slide in the photo.
How could you describe the steepness of the slide?

TRY THIS

Work with a partner.

This diagram shows different line segments on a square grid.



A. Think of a strategy to calculate a number to represent the steepness of each line segment.

B. Which is the steepest line segment? How does your number show that?

C. Which segment is the least steep? How does its number compare with the other numbers?

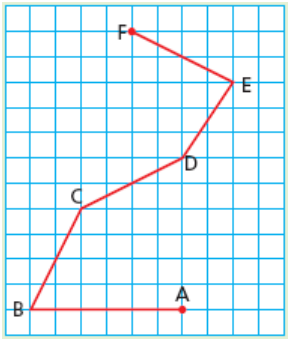
D. On a grid, draw a line segment that is steeper than segment CD, but not as steep as segment BC. Use your strategy to calculate a number to represent its steepness.

E. How are line segments CD and EF alike and different? How do the numbers for their steepnesses compare?

F. What number would you use to describe the steepness of a horizontal line?

$\frac{4}{2}=2$ $\frac{2}{4}=0.5$

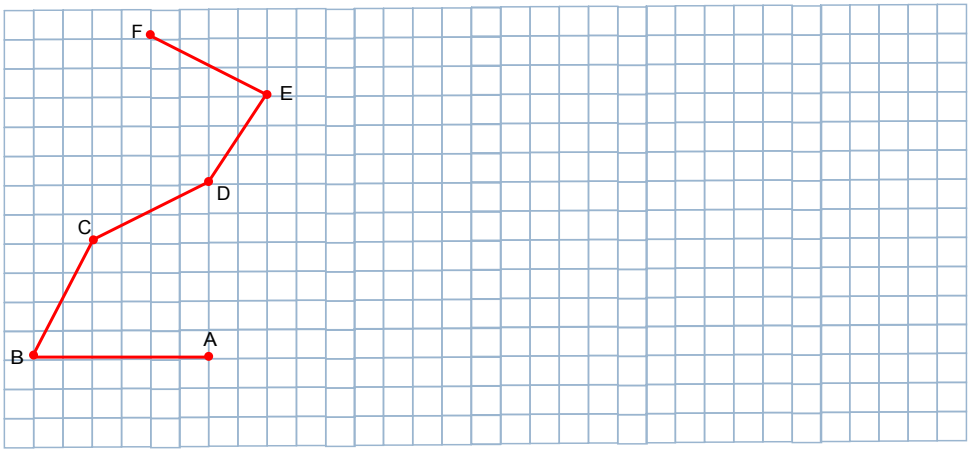
What strategy did you use to calculate a number to represent the steepness of each line segment?



Which is the steepest line segment?
How does your number show that?

Which segment is the least steep?
How does its number compare with the other numbers?

Draw a line segment that is steeper than segment CD, but not as steep as segment BC. What number did you use to represent its steepness?



How are line segments CD and EF alike and different?
How do the numbers for their steepnesses compare?

What number would you use to describe the steepness of a horizontal line?

Some roofs are steeper than others. Steeper roofs are more expensive to shingle.
The steepness of a roof is measured by calculating its **slope.**

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

The **rise** is the vertical distance from the bottom of the edge of the roof to the top.
The **run** is the corresponding horizontal distance.
For each roof, we count units to determine the rise and the run.

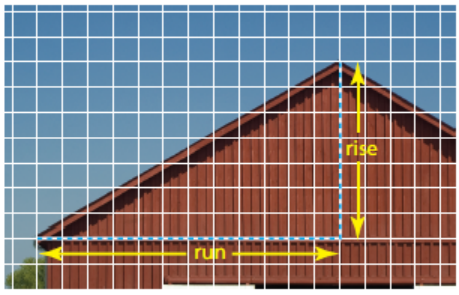
Roof A

For Roof A

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope} = ?$$

Roof B

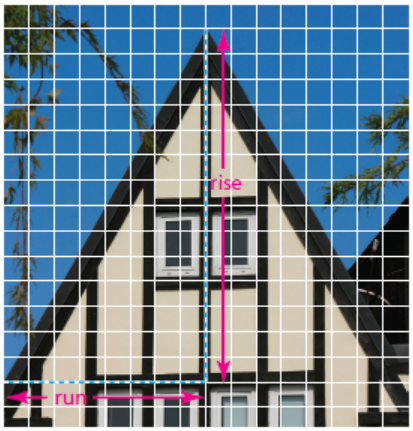


For Roof B

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope} = ?$$

Roof C



For Roof C

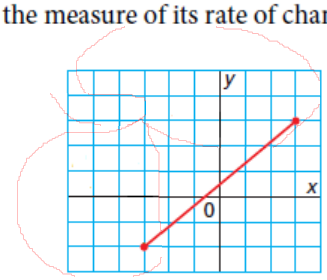
$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope} = ?$$

The slope of a line segment on a coordinate grid is the measure of its rate of change.
From Chapter 5, recall that:

$$\text{Rate of change} = \frac{\text{change in dependent variable}}{\text{change in independent variable}}$$

$$\text{Rate of change} = \frac{\text{change in } y}{\text{change in } x}$$



The change in y is ?
The change in x is ?

$$\text{So, slope} = \frac{\text{rise}}{\text{run}}$$

6.1 Slope of a Line

$$\text{Rate of change} = \frac{\text{change in dependent variable}}{\text{change in independent variable}}$$

$$\text{Rate of change} = \frac{\text{change in } y}{\text{change in } x}$$

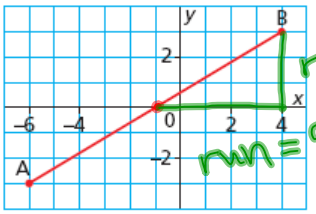
The change in y is the rise.
The change in x is the run.

$$\text{So, slope} = \frac{\text{rise}}{\text{run}}$$

Example 1 Determining the Slope of a Line Segment

Determine the slope of each line segment.

a)

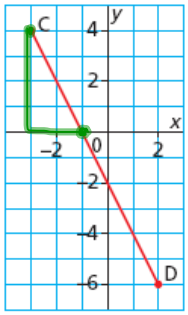


rise = 3

run = 5

slope is $\frac{3}{5} = 0.6$

b)



$\frac{4}{2} = 2$

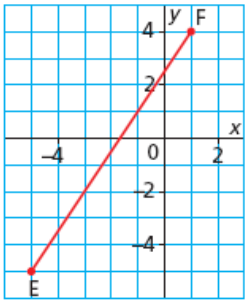
SOLUTION

6.1 Slope of a Line

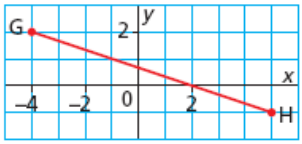
CHECK YOUR UNDERSTANDING

1. Determine the slope of each line segment.

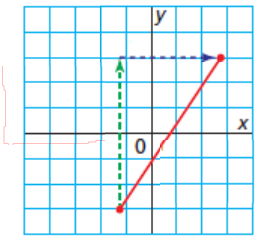
a)



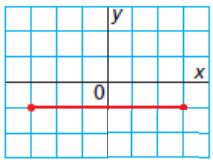
b)



When a line segment goes up to the right, both y and x increase; both the rise and run are ? so the slope of the segment is ?

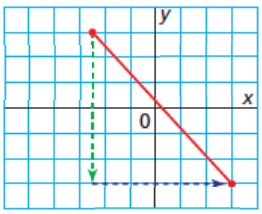


For a horizontal line segment, the change in y is 0 and x increases.
? ?

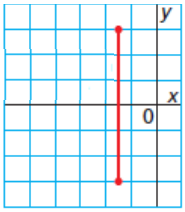


$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

When a line segment goes down to the right, y decreases and x increases; the rise is ? and the run is ? so the slope of the segment is ?



For a vertical line segment, y increases and the change in x is 0.
?



$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

?

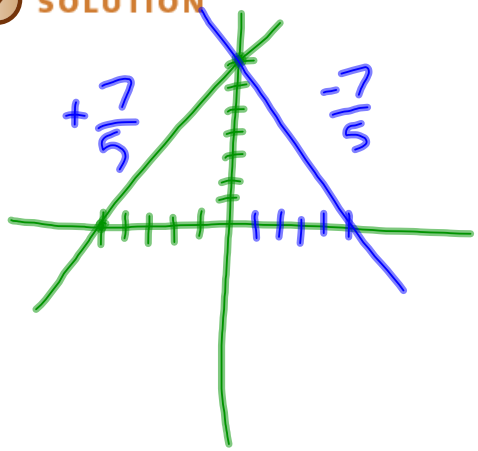
Example 2 Drawing a Line Segment with a Given Slope

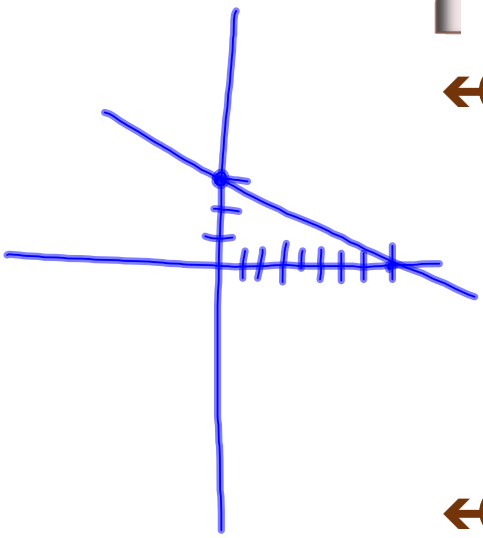
Draw a line segment with each given slope.

a) $\frac{7}{5}$

b) $-\frac{3}{8}$

SOLUTION



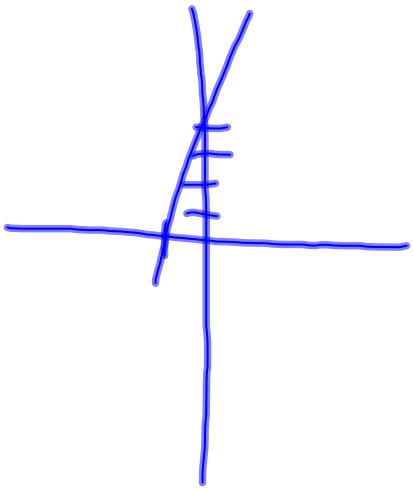


CHECK YOUR UNDERSTANDING

6.1 Slope of a Line

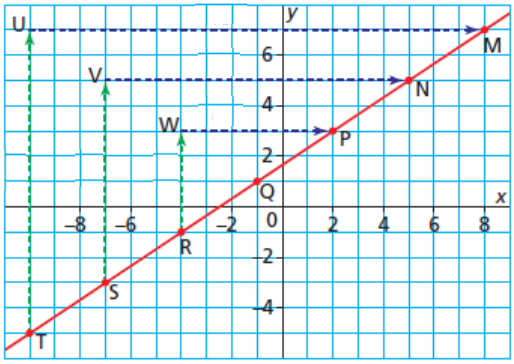
Slope = 4

$\frac{4}{1}$



We can show that the slopes of all segments of a line are equal.
On line MT, vertical and horizontal segments are drawn for the rise and run.
These segments form right triangles.
Consider the lengths of the legs
of these right triangles.

$\frac{TU}{UM} = ?$ $\frac{SV}{VN} = ?$ $\frac{RW}{WP} = ?$



?

Example 3 Determining Slope Given Two Points on a Line

Determine the slope of the line that passes through C(–5, –3) and D(2, 1).

SOLUTION

Slope of a Line

A line passes through $A(x_1, y_1)$ and $B(x_2, y_2)$.

$$\text{Slope of line AB} = \frac{y_2 - y_1}{x_2 - x_1}$$

Example:

Determine the slope of the line that passes through C(–5, –3) and D(2, 1).

$x_1\ y_1 \qquad x_2\ y_2$

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - (-3)}{2 - (-5)} = \frac{4}{7}$$

6.1 Slope of a Line

3. Determine the slope of the line that passes through E(4, –5) and F(8, 6).

$x_1\ y_1$

$x_2\ y_2$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - (-5)}{8 - 4} = \frac{11}{4}$$

Pg.339# 5-9, 13

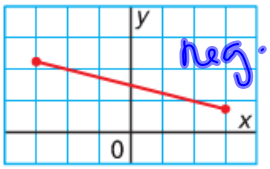
Friday, December 9th

- Check and go over homework Pg.339#5-9,13
- Review what slope means (example and practice questions).
- Begin Section 6.2
- Classwork/Homework

And don't forget about the trike fight at lunch hour!!! It's going to be a good one:)

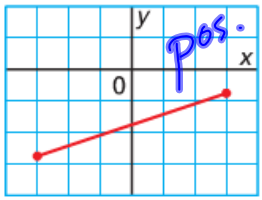
5. For each line segment, is its slope positive, negative, zero, or not defined?

a)



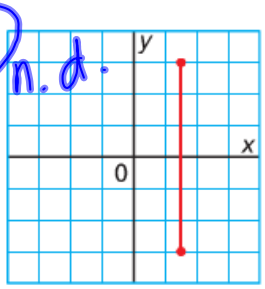
neg.

b)



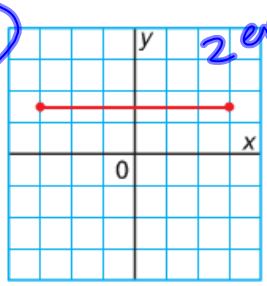
pos.

c)



n.d.

d)



zero

rise / run

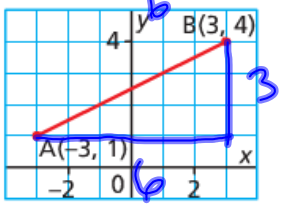
undefined

vert. = 8 = error

0/8 = 0

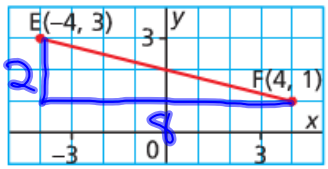
6. For each line segment, determine its rise, run, and slope.

a)



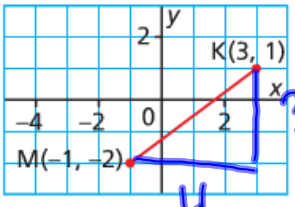
3/6 = 0.5

b)



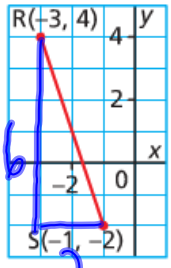
−2/8

c)



3/4

d)



6/2 = −3

7. Determine the slope of each line described below.

a) As x increases by 1, y increases by 3.

b) As x increases by 2, y decreases by 7.

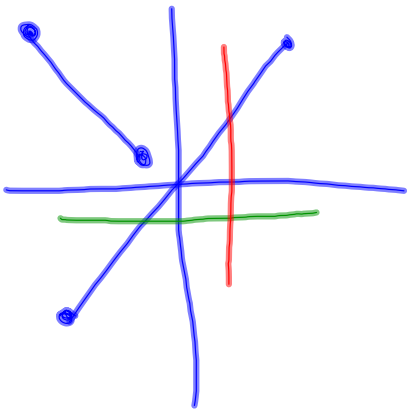
c) As x decreases by 4, y decreases by 2.

d) As x decreases by 2, y increases by 1.

8. Sketch a line whose slope is:

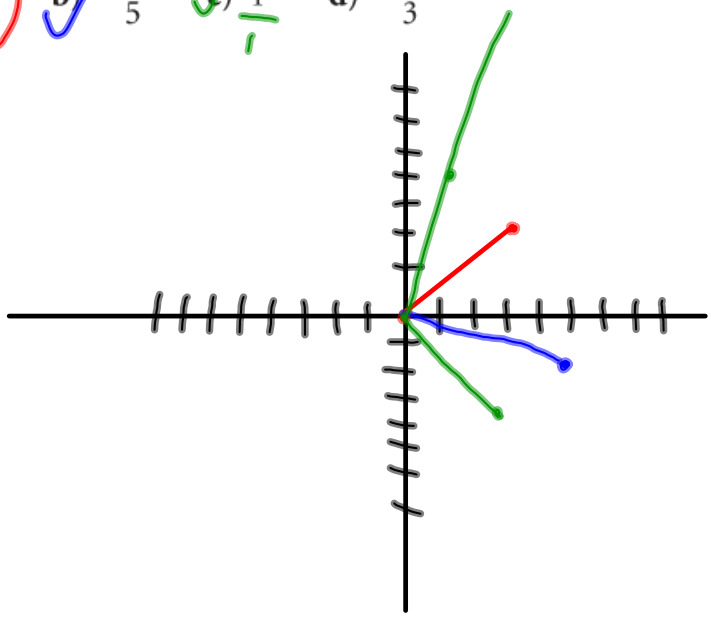
a) positive **b)** zero

c) negative **d)** not defined



9. Draw a line segment that has one endpoint at the origin and whose slope is:

a) $\frac{2}{3}$ **b)** $-\frac{2}{5}$ **c)** $\frac{4}{1}$ **d)** $-\frac{4}{3}$



13. **a)** Determine the slope of the line that passes through each pair of points.

i) P(1, 2) and Q(3, 6)

ii) S(0, 1) and T(8, 5)

iii) V(−1, 4) and R(3, −8)

iv) U(−12, −7) and W(−6, −5)

b) Explain what each slope tells you about the line.

$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

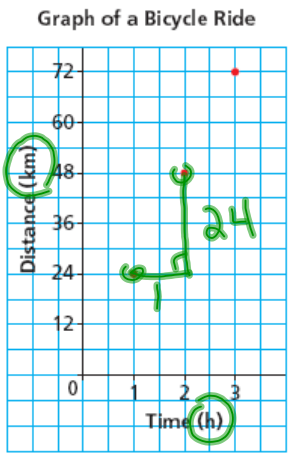
i) $\frac{6-2}{3-1} = \frac{4}{2} = 2$ ii) $\frac{5-1}{8-0} = \frac{4}{8} = \frac{1}{2} = 0.5$

iii) $\frac{4+(+8)}{(-1)-3} = \frac{12}{-4} = -3$

iv) $\frac{(-7)+(+5)}{(-12)+(+6)} = \frac{-2}{-6} = +\frac{2}{6} = \frac{1}{3} = 0.\overline{3}$

Example 4 Interpreting the Slope of a Line

Yvonne recorded the distances she had travelled at certain times since she began her cycling trip along the Trans Canada Trail in Manitoba, from North Winnipeg to Grand Beach. She plotted these data on a grid.



a) What is the slope of the line through these points?

24 Km/h

b) What does the slope represent?

A speed of 24 Km/h

c) How can the answer to part b be used to determine:

i) how far Yvonne travelled in $1\frac{3}{4}$ hours?

1.75

ii) the time it took Yvonne to travel 55 km?

SOLUTION

$\frac{55}{24} = 2.3$

i) $24 \times 1.75 = 42$ Km

$24 + 18$

CHECK YOUR UNDERSTANDING

Discuss the Ideas

1. When you look at a line on a grid, how can you tell whether its slope is positive, negative, 0, or not defined? Give examples.
2. Why can you choose any 2 points on a line to determine its slope?
3. When you know the coordinates of two points E and F, and use the formula to determine the slope of EF, does it matter which point has the coordinates (x_1, y_1)? Explain.

Please take these out:

Page 341 #17 to 20

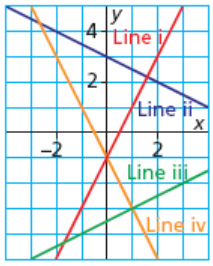
17. Match each line below with a slope. Explain your choices.

a) slope: -2

b) slope: $\frac{1}{2}$

c) slope: $-\frac{1}{2}$

d) slope: 2



17. a) Line iv
b) Line iii
c) Line ii
d) Line i

6.1 Slope of a Line

19. a) Explain why the slope of a horizontal line is zero.
b) Explain why the slope of a vertical line is undefined.

20. Four students determined the slope of the line through B(6, −2) and C(−3, −5). Their answers were: 3, -3, $\frac{1}{3}$, and $-\frac{1}{3}$

a) Which number is correct for the slope of line BC? Give reasons for your choice.
b) For each incorrect answer, explain what the student might have done wrong to get that answer.

$= \frac{(-5)+(-2)}{(-3)-6} = \frac{-7}{-9} = \frac{1}{3}$

slope $= \frac{y_2 - y_1}{x_2 - x_1}$

$\frac{(-5)-(-2)}{-3+6}$